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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2016/2017

EEL4106 – HIGH VOLTAGE ENGINEERING
(LE)

15 OCTOBER 2016
14:30 pm – 16:30 pm
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 3 pages including the cover page with 4 Questions only.
2. Answer **ALL** questions. The distribution of the marks for each question is given.
3. Please write all your answers in the Answer Booklet provided.

Question 1

- (a) State at least 4 advantages of high voltage series resonant transformer. [8 Marks]
- (b) A 100 kVA, 250/200 kV feed transformer has resistance and reactance of 3.75% and 10% respectively. This transformer is used to test a cable at 320 kV, 50 Hz. The cable takes a charging current of 0.64 A at 320 kV. Determine the series inductance required. [7 Marks]

- (c) A 6-stage impulse generator is designed to deliver an output voltage given by:

$$v_{out}(t) = 0.58(e^{-300t} - e^{-27500t}) \text{ kV}$$

The charging voltage per stage is 10 kV. Calculate the efficiency of the generator. [10 Marks]

Question 2

- (a) A 12-stage impulse generator has 0.126 μF capacitors. The wave front and the wave tail resistances are 800 Ω and 5000 Ω , respectively. If the load capacitor is 1000 pF, find the front and tail times of the impulse wave produced. In order to generate a 1.2/50 μs lightning impulse how the front and tail resistances should be altered? [7 marks]
- (b) List all the tests to be carried out on circuit breakers. [5 Marks]
- (c) A Schering Bridge having a standard compressed air capacitor of 100 pF, a non-inductive resistor of 800 Ω in parallel with a variable capacitance C_2 , and a non-inductive variable resistor R_2 is used to test a bakelite sheet at 50 Hz. If balance is obtained with $C_2 = 0.432 \mu\text{F}$ and $R_2 = 200\Omega$, determine the power factor and the permittivity of the sheet using series equivalent model of the bakelite. Assume sheet dimension of 11 cm \times 11 cm \times 1 cm. [13 Marks]

Question 3

- (a) Draw the equivalent circuit of a dielectric material with a cavity and derive the expression for partial discharge in terms of capacitance. [11 Marks]
- (b) A cylindrical disc of 1.0 cm diameter and 1.0 cm thickness having a cylindrical cavity of 1.0 mm diameter and 1.0 mm thickness at its center is employed to perform partial discharge studies in cavities. The discharge voltage measured across the specimen is 0.4 V with sensitivity of 0.8 pC/Volt. Compute the magnitude of the charge transferred from the cavity. Assume the relative permittivity of the disc to be 3. [8 Marks]

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- (c) The breakdown of a certain gas occurs at a uniform electric field between two plane electrodes having a spacing of 1.0 cm. If the Townsend's second ionization coefficient γ is 0.001 find the value of the Townsend's primary ionization coefficient α . [6 Marks]

Question 4

- (a) Highlight the characteristics of surge diverters for overvoltage protection of high voltage equipment. [8 Marks]
- (b) Explain partial discharges and briefly discuss on all types of partial discharges. [11 Marks]
- (c) A 900 kV, 1 μ s rectangular surge on a line having surge impedance of 300 Ω approaches the terminal ending with a concentrated earth capacitance of 3333.33 pf. Determine the maximum value of the transmitted wave. [6 Marks]

End of paper